EO-FIN

Coastal Erosion

Shoreline changes along the coast of Malgrat de Mar, Spain. The 1994 coastline data is extracted from US Landsat data while the 2019 data is from the Copernicus Sentinel-2 mission. (Source: ESA).

Product Category

☐ Land Use	☐ Natural Disaster	■ Coast Management	☐ Earth's Surface Motion
☐ Land Cover	☐ Climate Change	☐ Marine	

Financial Domain(s)

■ **Investment management** ■ **Risk analysis** ☐ **Insurance management** ☐ **Green finance**

User requirements

UN12: Analysis of potential risks in specific regions
UN14: Need to screen the feasibility of projects against different hazard criteria.
UN37: Projection of risk to portfolio assets into future
UN40: Need to monitor the risk of sea level rise threatening coastal property, infrastructure, and supply chains

Description

Coastal erosion poses significant risks to properties, developments, and investments in coastal areas. Monitoring erosion enables financial institutions to identify high-risk properties, estimate potential losses, and make informed decisions about lending, insurance, and investment activities' paraphrase. Earth observation data allows for the comparison of optical images acquired at different times to detect changes along the coastline. By analysing these images, it is possible to identify erosional hotspots, quantify shoreline retreat, and assess the magnitude of coastal erosion.

Spatial Coverage Target

Coasts

Data Throughput

Rapid tasking	☐ High	■ Low
Data availability	☐ High	■ Low

Product specifications	
Main processing steps	Coastal erosion monitoring involves tracking changes in shoreline dynamics over time. This approach can be developed using medium-resolution optical satellite imagery like Sentinel-2 and Landsat (for long-term coastal erosion monitoring). The fundamental concept is to establish a reference dataset representing the normal shoreline and then compare it with images from various time periods. This process identifies regions experiencing erosion or accretion and quantifies the rate of change over the years. To accurately differentiate between water and land areas and identify the shoreline, spectral indices like the Normalized Difference Water Index (NDWI) or Modified NDWI can be utilized, applying a threshold to distinguish these regions. To estimate the rate of coastline change, a transect-based method can be employed. This involves calculating the distance between a user-defined reference baseline and multitemporal coastlines using transects generated along the baseline at specified intervals.
Input data sources	Optical: Sentine-2, Landsat Radar: N.A Supporting data: N.A
Accessibility	Sentinel-2: freely and publicly available from ESA. Landsat: freely and publicly available from NASA.
Spatial resolution	Sentinel-2: 10 m Landsat: 30 m
Frequency (Temporal resolution)	Sentinel-2: 6 days Landsat: 16 days
Latency	≤ 1 day
Geographical scale coverage	Globally
Delivery/ output format	Data type: Raster File format: GeoTIFF
Accuracies	Thematic accuracy: 80-90% Spatial accuracy: 1.5-2 pixels of input data
Constraints and limitations	■ Cloud presence ■ Variability in sea level due to tides, storm surges, and other factors can introduce noise and uncertainty in detecting shoreline shifts. ■ Subpixel changes in shoreline positions might be challenging to detect and measure accurately, impacting erosion rate calculations. ■ Availability of high spatial and temporal resolution historical satellite imagery might be limited.
User's level of knowledge and skills to extract information and perform further analysis on the EO products.	Skills: Essential Knowledge: Essential